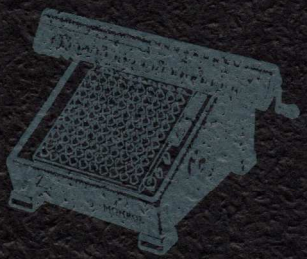
INSTRUCTION BOOK



LA Models

MONROE
ADDING-CALCULATOR

MONROE CALCULATING MACHINE COMPANY, INC.

INSTRUCTION BOOK

Monroe Adding-Calculator

LA-X or Series 0 Models

Form 809-S

Printed in U. S. A.

MONROE
CALCULATING MACHINE COMPANY, INC.

General Offices and Factory
ORANGE, NEW JERSEY

Monroe Sales and Service Available in all Principal Cities of the United States and throughout the World

Foreword

THIS book is designed to enable operators to use the Monroe Adding-Calculator to the best advantage.

The instructions are written in a simple style so that they may be readily understood, even by those who may never have used an adding or calculating machine. They should enable operators to add, subtract, multiply, and divide, and to work out all ordinary commercial problems without other assistance.

Part I gives instructions for performing the fundamental arithmetical operations—addition, subtraction, multiplication, and division—with rules for handling decimals.

Part II describes easy methods for shortening certain types of figure work and outlines methods of handling basic business figuring problems.

Examples are given to show the wide adaptability of the Monroe Adding-Calculator and its effective application to modern office figuring. No attempt can be made, however, in this comparatively small book to describe all of the many uses of the machine, which can handle any kind of figure problem no matter how complicated.

The instructions contained in this book apply in general to the LA-X line of Monroe Adding-Calculators. Certain models of the LA line, such as the LA-5 and the LA-6 model Monroes, have additional automatic features which further simplify and speed up figure work. Small instructional leaflets have been prepared which explain the functions of these special features. These instructions should be followed in conjunction with this book in learning the operation of the special features in order to get the greatest benefit from these machines. The leaflets, Form 774-S for the LA-5 Monroe and Form 775-S for the LA-6 Monroe, will be supplied upon request.

Further and more specific instructions in the use of Monroe Adding-Calculators and their application to special types of work will be furnished upon request. Monroe offices are located in all principal cities. You may get in touch with our representative nearest you by referring to your local telephone directory, or if you prefer, write to the Accounting Service Department, Monroe Calculating Machine Company, Inc., Orange, New Jersey.

Monroe Operation

A Monroe Adding-Calculator should be at hand in following these instructions in order to master the operation of the machine. For the easiest and most natural method of operation, the general directions given below should be observed.

Place the machine slightly to the right in front of you, turned at a slight angle to the right.

To depress the keys on the keyboard, use the fore and middle fingers of the right hand.

The right hand is also used to operate the plus and minus bars, or in hand operated models, to turn the operating crank. For ease of operation, place the machine so that the wrist can rest on the desk when using the plus and minus bars for multiplication or division.

In clearing the dials use the thumb, fore, and middle fingers of the right hand. Make a complete turn either forward or backward depending upon which set of dials is to be cleared. The crank must always be stopped at the bottom of the turn.

On hand operated models the operating crank must be stopped at the top. This crank is turned with a wrist motion. When the wrist motion is used, the crank is easily brought to a stop in the top position but if a full arm movement is used, difficulty may be experienced in stopping the crank at the top.

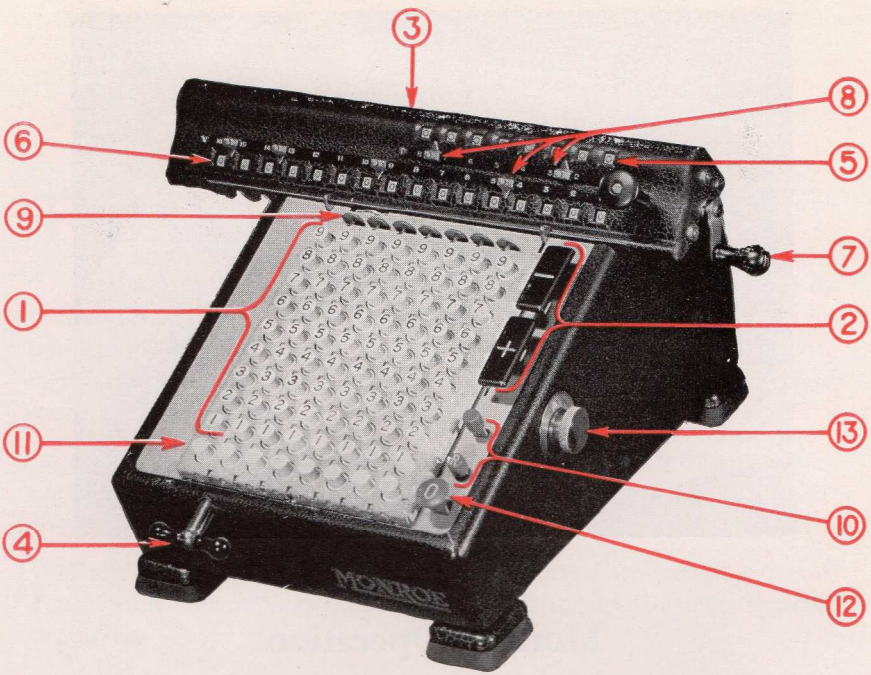


Figure 1

Monroe Adding-Calculator

Model LA 160-X

1 Keyboard
2 Plus and Minus Bars
3 Carriage
4 Carriage Shift Lever
5 Upper Dials
6 Lower Dials
7 Dials Clear-out Crank
8 Decimal Markers on Dials
9 Decimal Markers on Keyboard
10 Repeat and Non-Repeat Keys
11 Individual Column Release or Zero Keys
12 Master Clear Key
13 Crank Hole Cover

MONROE INSTRUCTION BOOK

PART I

Various Parts of the Machine Their Operation and Use

The Monroe Adding-Calculator, as its name implies, is an adding and calculating machine capable of performing the four fundamentals of arithmetic—addition, subtraction, multiplication, and division—with accuracy, speed, and simplicity.

The machine is basically designed with three principal functional parts: A standard keyboard (1 in Fig. 1) for setting up the amounts to be added, subtracted, multiplied or divided; the plus and minus bars (2 in Fig. 1), or operating crank in hand models, located at the right of the keyboard, for performing the four fundamental arithmetical operations; and the carriage (3 in Fig. 1) at the top of the machine in which are contained the dials which register the results and proofs of the various operations as they are performed.

All Monroe Adding-Calculators operate on the same basic principle; namely, a forward movement for addition and multiplication and a backward or reverse movement for subtraction and division. This is true regardless of whether the machines are actuated by hand or motor power.

On the electric models addition and multiplication are accomplished by the use of the plus bar, subtraction and division by the use of the minus bar. Any electric model Monroe is readily convertible for hand operation by the insertion of the hand operating crank.

On the hand operated models operations are performed by the use of a hand crank conveniently located at the right of the keyboard; a forward turn is used for addition and multiplication, a backward turn for subtraction and division.

Since the principles of operation are basic for all Monroe models these instructions apply to any Monroe Adding-Calculator equipped with one set of upper dials, even though they have been written for a specific model —the LA-X. For Monroe Adding-Calculators equipped with two sets of upper dials, another instruction book is available.

If a hand operated Monroe with one set of upper dials is in use, these instructions should be followed except that where a depression of the plus bar is indicated the hand operating crank must be moved in a forward turn, and where a depression of the minus bar is indicated, the crank must be moved in a backward turn.

In operating hand machines, complete forward or backward turns of the operating crank should always be made, otherwise the machine automatically locks to guard against operating errors. The stopping place or neutral position is when the crank is at the top of the turn (or in an upright position). This neutral position is located almost automatically if a rotary wrist movement is used in operating the crank.

In the following descriptions of the parts of the Monroe, the numerals refer to the key numbers in Figure 1.

(1) *Keyboard*

The Monroe keyboard is the standard flexible type. By depressing the keys, which have been constructed with a "Velvet Touch," amounts to be added, subtracted, multiplied, or divided are set up. On all models the depressed keys enable the operator to read the amounts as they are set up. On certain models such as the LA-X line, the depression of a key causes a "Shadow Ring" to appear around the key, further accentuating the depressed key. Thus any error may be detected and corrected immediately after being set up, simply by depressing the correct key. This operation automatically restores the key which has been incorrectly depressed in the same column.

(2) *Plus and Minus Bars*

The plus bar is depressed once for each amount to be added in addition. In multiplication this bar is held in a depressed position until the required multiplier is registered in the dials. This action of the plus bar is the equivalent of forward turns of the operating crank on hand operated models.

The minus bar is depressed once for each amount to be subtracted in subtraction. In division or subtractive multiplication this bar is held in a depressed position until the required quotient digit or multiplier is registered in the dials. This action of the minus bar is the equivalent of backward turns of the operating crank on hand operated models.

(3) *Carriage*

The carriage may be moved to right or left as required. The figures in the dials of the carriage are always in direct vertical alignment with the rows of keys on the keyboard; thus a depressed key in any column will always operate the dial in the carriage which is in direct alignment with that row of keys.

(4) *Carriage Shift Lever*

The carriage may be instantly shifted to the left or right as desired by a half turn of the carriage shift lever.

To shift the carriage a number of places, the carriage can be raised and moved the number of spaces desired by means of the hand shifting knob on the right end of the carriage.

(5) *Upper Dials*

The upper dials show the multiplier in multiplication, as a basis for proving the calculation, and in division they show the quotient or result.

The upper dials are a single set of dials with black and red figures. The black figures register plus or forward operations of the machine. The red figures register minus or backward operations of the machine.

(6) *Lower Dials*

The lower dials show the result in addition and multiplication, the remainder in subtraction, and the dividend in division.

(7) *Dials Clear-out Crank*

To clear out the upper dials, turn this clear-out crank forward one complete turn, stopping the crank at the bottom. To clear the lower dials, make a complete backward turn of the crank, stopping at the bottom. If any turn of the crank has been started it is not possible to reverse the turn. The turn must be fully completed before a reverse turn can be made.

(8) *Decimal Markers on Dials*

These movable markers are set in advance for the number of decimal places required for the work. They can be easily moved to any position and should be set between the dials where the decimal point is required.

(9) *Decimal Markers on Keyboard*

These markers between each column of keys are turned over by means of knurled knobs at the top of the keyboard. When turned over either a broken or a solid red line, depending upon the model, between the rows of keys indicates the position of the decimal point on the keyboard.

Similar to the decimal markers on the dials, the keyboard decimal markers have no mechanical connection with the working parts of the machine, being used simply as an aid and guide in determining definitely the location of the decimal points.

(10) *Repeat and Non-Repeat Keys*

Between the plus bar and the large red key is a red key marked "R". This is the repeat key, and when it is depressed keys set on the keyboard remain locked down until cleared by the operator. The repeat key must be depressed for all operations involving multiplication and division.

Directly below the plus bar is a red key with no designation. When this key is depressed, all keys set on the keyboard are automatically released after each revolution of the machine. Never depress this key for operations of multiplication and division.

Depressing the repeat key automatically raises the non-repeat key, and depressing the non-repeat key automatically raises the repeat key.

(11) *Individual Column Release or Zero Keys*

The keys located below the "1" keys at the bottom of each row of keys are in some models marked with a "0" or zero and in other models are not marked.

In some models they are always depressed except when amounts are set on the keyboard, in other models they are always in a raised position.

Regardless of these slight differences in construction, these keys on all models individually clear any column of keys in which they are in direct alignment without disturbing the set-up in other columns. They are also used to correct to a cipher any figure key in the same column which may have been set in error.

On models where the zero keys remain in a depressed position, they assist the operator to see at a glance where ciphers occur in the amount set up.

(12) *Master Clear Key*

The large red key at the lower right hand corner of the keyboard marked "0" is depressed to clear the entire keyboard of any amount set up, and at the same time, in some models, depresses all zero keys.

On certain models, to prevent unintentional clearance of the keyboard when a constant factor is being used, the master clear key acts as a keyboard lock. When used for this purpose, the master clear key is held down with the left hand while the keys are being set up on the keyboard with the right hand. A locked keyboard set-up is cleared by depressing the plus bar with the non-repeat key depressed and then clearing the dials.

(13) *Crank Hole Cover*

To the right of the plus bar on the side of the case of all electric models is the crank hole cover which revolves when either the plus or the minus bar is operated.

To remove, hold back the small lever located under the plus bar near the keyboard and pull out the cover. Then a hand crank can be inserted in its place and the electric model is ready for hand operation.

This important feature assures continuous use of the machine even during a temporary break-down of electric power or in a temporary location where electric outlets are not available.

Fundamental Operations
Addition, Subtraction, Multiplication, Division

Addition

Addition can be accomplished with the carriage in any position, but it is recommended that the carriage be shifted to the left as far as it will go when adding. This position is called the "1" position.

The numerical position of the carriage is determined by noting the small number shown on the decimal point marker strip over the lower dials and its alignment with the extreme right-hand row of keys. If the small number "4" is in line with the last row of keys on the right-hand side, the carriage is designated as being in the "4" position.

Addition is best accomplished by the "locked figure" method, that is, with the repeat key depressed.

Example: $325 + 456 + 222 = 1003$

Method

Step 1—Set 325 on extreme right of keyboard with carriage in "1" position. Depress plus bar once. The machine makes one revolution and the 325 appears automatically in the lower dials.

Step 2—Change keyboard set-up to 456. Depress the plus bar once; automatically 456 is added to 325 and the result is in the lower dials.

Step 3—Change keyboard set-up to 222. Depress the plus bar once and the final result, 1003, appears in the lower dials as shown in Figure 2. The upper dials show 3 indicating the number of items added. When more than 9 items are added the upper dials figure is disregarded.

Step 4—Clear the dials and keyboard so that the machine is ready for the next figuring problem.

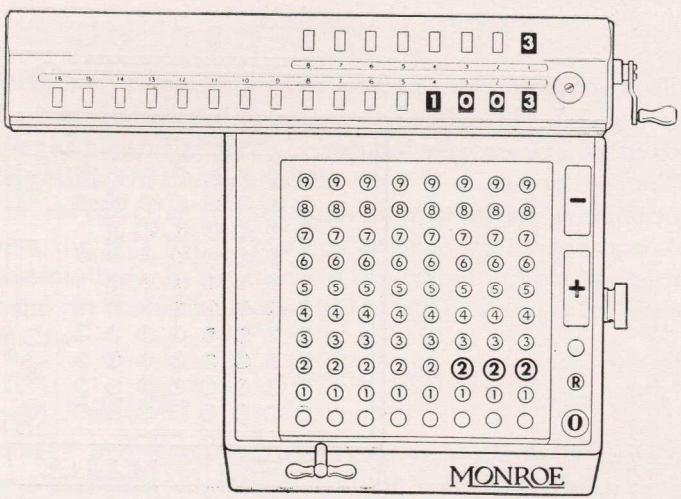


Figure 2

Subtraction

On the Monroe Adding-Calculator subtraction is a direct operation and is accomplished just as easily as addition.

Example: 1003 − 325 = 678

Method

Step 1—Set 1003 on extreme right of keyboard. Depress plus bar once. The larger amount is now added and appears in the lower dials.

Step 2—Change keyboard set-up to 325. Depress minus bar once. The lower dials now show the remainder and final answer, 678.

Step 3—If proof of the addition of 1003 is desired, depress the plus bar again and the original amount added, 1003, appears in the lower dials.

Step 4—Subtraction can also be performed by the reverse method. With lower dials clear, set the smaller number, 325, on the keyboard and depress minus bar once. Disregard complementary amount in lower dials.

Step 5—Change keyboard set-up to 1003 and depress plus bar once. Lower dials now show the remainder, 678.

Multiplication

Multiplication is a series of repeated additions, and is a simple process on the Monroe. It is accomplished by setting one amount on the keyboard and "writing" the other amount in the upper dials with the plus bar. In all operations of multiplication the repeat key must be depressed.

Example: 789 × 234 = 184626

Method

Step 1—With carriage in "1" position set 789 on extreme right of keyboard as shown in Figure 3. Depress plus bar until 4 appears in upper dials.

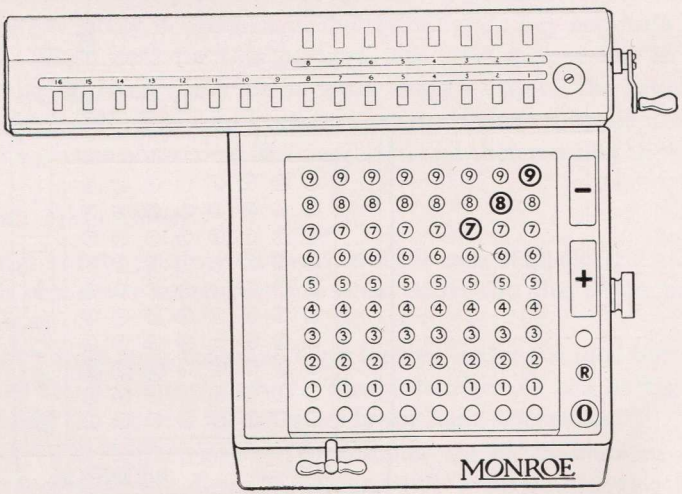


Figure 3

Step 2—With carriage shift lever, shift the carriage one place to the right. Depress plus bar until 3 appears to the left of the 4, then shift carriage again one place to the right and produce 2 in the next upper dial by holding plus bar down.

Step 3—Upper dials now read 234, the multiplier; the keyboard (keys depressed) reads 789, the multiplicand; and the lower dials read 184626, the result. This is complete and positive proof of accuracy. The only further proof required is a visual check of 234 and 789 in the machine against the two specified amounts. If the amounts in the machine agree with those specified the result must be correct. See Figure 4.

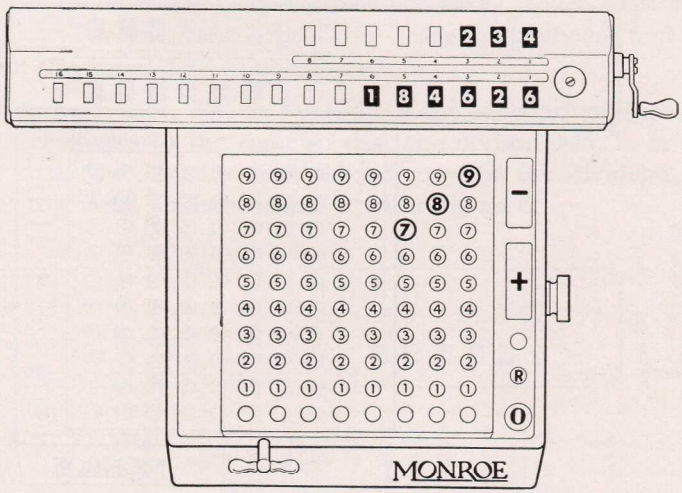


Figure 4

If the plus bar is held down too long in multiplication, a number greater than that desired will appear in the dials. This is not a serious error because the higher figure can be reduced very quickly to the correct figure by depressing the minus bar. Similarly if a figure in the multiplier is found to be less than the required figure, correction can be made quickly by depressing the plus bar. Thus any error made by the operator in recording the multiplier in the machine can instantly be detected in the upper dials and the correction made quickly and easily with the use of the plus or minus bar.

Changing the Multiplier

Correction of multipliers just described very naturally leads to an explanation of problems requiring a constant multiplicand with changing multipliers.

At the completion of the previous problem (See Figure 4), the machine shows 789 on the keyboard, 234 in the upper dials, and 184626, the result, in the lower dials. Suppose 789 is constant as a multiplicand. We wish to change the multiplier 234 to 432.

Do not clear the machine. With carriage in the "3" position, with the plus bar add twice, changing the 2 in the third upper dial to 4. By means of the carriage shift lever, move the carriage to the "1" position. With the minus bar change the 4 in the first upper dial to 2. The result in the lower dials is 340848 and the dials appear as follows:

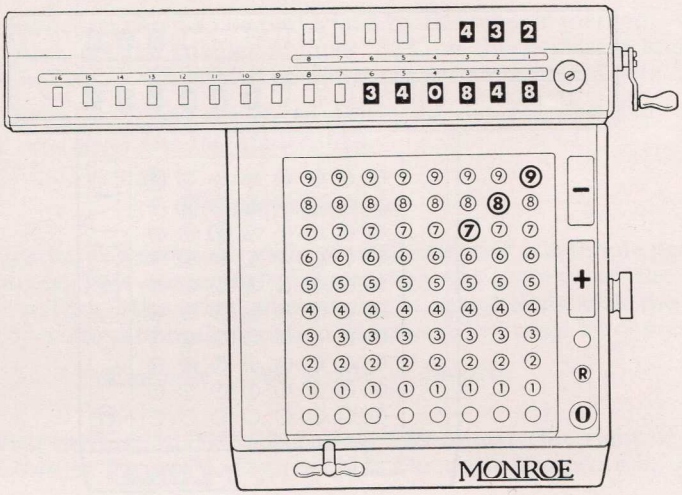


Figure 5

The entire operation is extremely simple. It requires no expert knowledge, skill, or training, and you know your result is absolutely accurate because all the figures you have used are visible in the machine.

Multiplication on the Monroe Adding-Calculator may be performed in either direction. For example, in the above multiplication (789 × 432) you may begin as explained by multiplying first by the 4 hundreds in the multiplier, shifting the carriage to the left to put in the 3 tens, and shifting again to register the 2 units; or you may begin by registering the 2 units in the first dial, shifting the carriage to the right and multiplying by 3 in the tens column, and shifting again to the right to multiply by 4 in the third or hundeds column of the upper dials. The result will be the same in either case; as long as the multiplier agrees with the required figure the answer is sure to be accurate.

Division

On the Monroe, division is performed with the same ease, simplicity, and directness as multiplication. As multiplication is a process of continued or repeated additions, accomplished by the use of the plus bar, so division is a process of continued subtractions and is accomplished by the use of the minus bar.

Example: 477591 ÷ 224 = 2132, Remainder 23

Method

Step 1—With carriage in "1" position set the dividend, 477591, on the extreme right of keyboard. Depress plus bar once. Touch master clear key and minus bar simultaneously. This clears the keyboard and clears out the 1 in the upper dials in one operation.

Step 2—Set the divisor, 224, on the right of the keyboard and move the carriage three spaces to the right so that the divisor, 224, is in direct alignment with the 477, the first three figures of the dividend. The machine at this point appears as indicated in Figure 6.

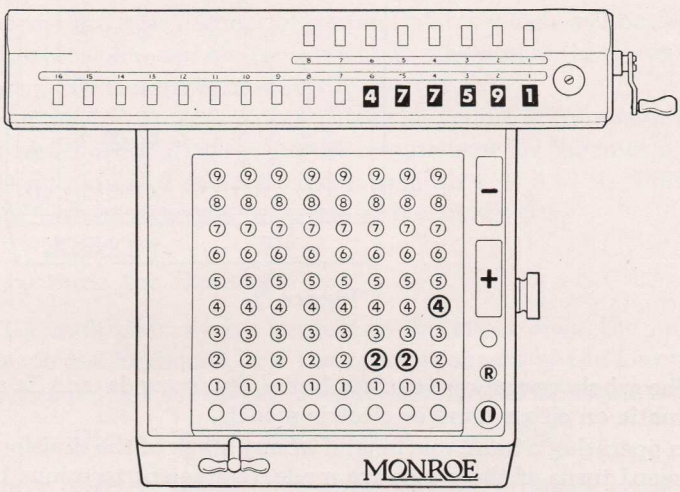


Figure 6

Step 3—Depress the minus bar until the machine stops, then depress the plus bar once. The red 2 in the upper dials is the first figure of the result as shown in the first step of the illustration on page 14.

Step 4—Shift the carriage to the "3" position, hold the minus bar down until the machine stops and depress the plus bar once. The result in the upper dials will be a red 1 .

Step 5—Continue this operation, shifting the carriage and depressing minus and plus bars. At the completion of the problem the quotient, 2132, will appear in the upper dials and the remainder, 23, will appear in the lower dials. The machine at this point appears as shown in Figure 7.

Illustration of all steps—The figures as they appear on the machine at the end of each step are as follows:

	First Step	*Second Step*	*Third Step*	*Fourth Step*
Upper Dials	00002000	00002100	00002130	00002132
Lower Dials	00029591	00007191	00000471	00000023
Keyboard	00000224	00000224	00000224	00000224

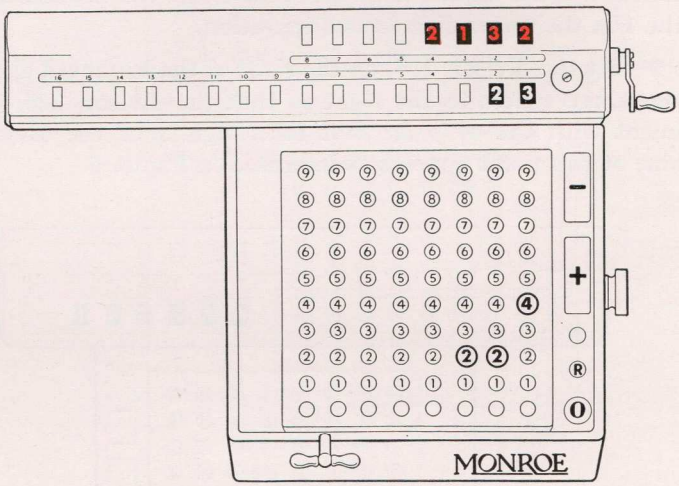


Figure 7

The whole operation requires but a few seconds and is simple and automatic on either hand or electric models.

In operating a hand machine, if at any stage of the division too many backward turns of the crank are made, equivalent to minus bar depressions, a row of nines appears to the left of the dividend and a bell rings, instantly indicating that an over-division has been made.

To correct, merely turn the crank forward, restoring all the figures as they appeared prior to the over-division. When this point is reached the bell rings again, indicating that the correction has been made. An advantage of this second bell signal is this: in fast operation the operator might over-divide more than one extra turn of the crank. The second bell tells the operator when to stop the forward correcting turn of the crank regardless of how many turns may be necessary. The operator need not watch the machine to determine this.

Decimals
Use and Rules for Pointing Off

On all calculating machines fractions are expressed as decimals. For example: $\frac{1}{4} = .25$; $\frac{5}{8} = .625$.

The arrangement of the dials and keyboard in the Monroe Adding-Calculator makes it particularly adapted to the handling of calculations involving decimals. The fact that the Monroe shows all three factors of a calculation and that the dials are always in direct alignment with the rows of keys makes possible a decimal set-up for the entire problem which guarantees accurate decimal points in the result.

Fixed Decimal Points

It is possible on a calculator to set decimal points for each individual problem regardless of the variation in number of decimal places. On the Monroe, however, savings in time and increase in decimal point accuracy can be effected by using the fixed decimal point method.

In using the fixed decimal point method, first determine from the work to be done the greatest number of decimal places which will be required for both the multiplier and the multiplicand. The sum of these two figures will be the number of decimal places in the result.

For example, if 4 decimal places are the maximum requirement for the multiplier and 5 decimal places are the requirement for the multiplicand, the result will require 9 decimal places, because $4 + 5 = 9$. This leads to a simple formula expressed in terms of machine parts.

Monroe Formula for Decimals

Since the multiplier always appears in the upper dials, the multiplicand is set on the keyboard, and the result is shown in the lower dials, Monroe decimal point set-up can be expressed by the following formula:

Upper Dials + Keyboard = Lower Dials

Note how directly this formula applies to the ordinary arithmetical rule for handling decimals, that is, point off as many places in the result as there are decimal places in the other two factors combined.

Multiplication of Decimals

To illustrate the fixed decimal point principle, we shall assume that an examination of our problems shows the maximum number of decimal places required is as follows: upper dials 3, keyboard 3, lower dials 6.

Example: $20.125 \times .425 = 8.553125$

Method

Step 1—The largest number, 20.125, will be set on the keyboard. Turn over decimal marker at 3. Set 20.125 on right of keyboard.

Step 2—Move upper dials decimal marker to 3 and lower dials marker to 6. With carriage in "1" position multiply successively with the plus bar by 5, 2, and 4, shifting the carriage for each digit.

Step 3—The result in the lower dials will be 8.553125, correctly pointed off. See Figure 8. If the result is dollars and cents it would be copied from the lower dials as $8.55, ignoring the terminal digits 3125. If these digits were 5125 instead of 3125, the half cent would be picked up and the result would be copied as $8.56 instead of $8.55.

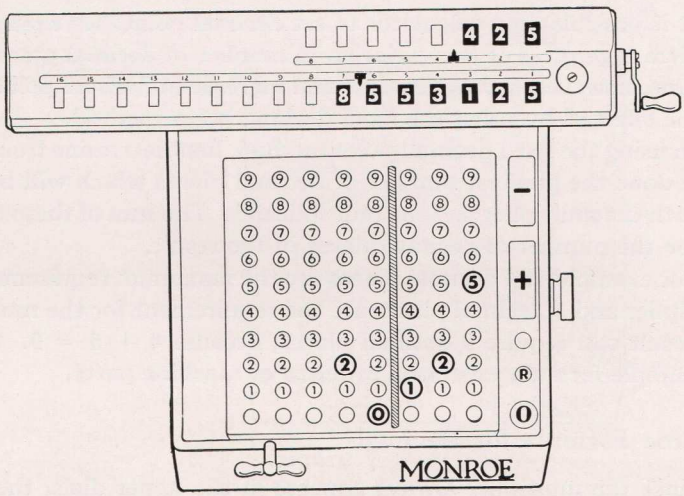


Figure 8

Suppose we now take an example where the maximum decimal places used in the previous example will not be used entirely.

Example: $24.75 \times .35 = 8.6625$

Method

Decimals: Upper Dials 3
Keyboard 3
Lower Dials 6

Step 1—The larger amount or multiplicand is 24.75. The keyboard fixed decimal point is at 3, so when 24.75 is set on the keyboard it appears as 24.750.

Step 2—The upper dials fixed decimal point is at 3, so .35 is placed in the upper dials by means of the plus bar as .350. This is accomplished by starting to multiply with the carriage in the "2" position instead of the "1" position.

Step 3—The result will appear in the lower dials as 8.662500 correctly pointed off.

Step 4—The ciphers to the right of the significant figures in all three factors indicate what portion of the fixed decimals were not used in this particular problem.

Step 5—In the upper dials on the right of the multiplier is 1 cipher, on the keyboard is 1 cipher and in the lower dials are 2 ciphers. In other words, the formula still holds, $1 + 1 = 2$.

Step 6—The actual problem required $2 + 2 = 4$ decimals. The fixed decimal set-up was $3 + 3 = 6$. Therefore $2 + 2 = 4$ decimals plus $1 + 1 = 2$ ciphers is equal to the fixed decimal set-up of $3 + 3 = 6$.

Division of Decimals

In division the same principle of pointing off decimals applies as that just described for multiplication. That is, the sum of the decimal places in the upper dials and the keyboard must agree with the number pointed off in the lower dials.

Example: $22.868 \div 6.7 = 3.4131$

Method

Step 1—The quotient is to be carried out to three decimal places. Since the quotient will be shown in the upper dials we start fixing the decimal marker in those dials. We always set our decimal marker at one more place than that required in the quotient in order that our answer may be accurately adjusted. Therefore, $3 + 1 = 4$ places in the upper dials.

Step 2—To accommodate a maximum number of 3 decimals placed in the divisor, we turn over the keyboard marker at 3, even though in this particular problem the divisor contains only 1 decimal place.

Step 3—The keyboard and upper dials decimal points are now set at 3 and 4 respectively. Therefore, the decimal point in the lower dials is set at 7 in accordance with the Monroe Formula: $3 + 4 = 7$.

Step 4—The first operation is to add the dividend, 22.868, in the lower dials. Set 22.868 on the keyboard. Move the carriage to the "5" position so that 22.868 will show in the lower dials correctly pointed off at the decimal point in the 7th place. See Figure 9.

Step 5—In adding the dividend a 1 appears in the upper dials. Always clear this 1 before setting the divisor on the keyboard. The keyboard and upper dials may be cleared in one operation by touching the master clear key and the minus bar simultaneously.

Step 6—Set 6.7 on the keyboard so that it appears as 6.700. Have the carriage in the "5" position so that 6.7 can be subtracted from the 22.8 of the dividend. See Figure 9.

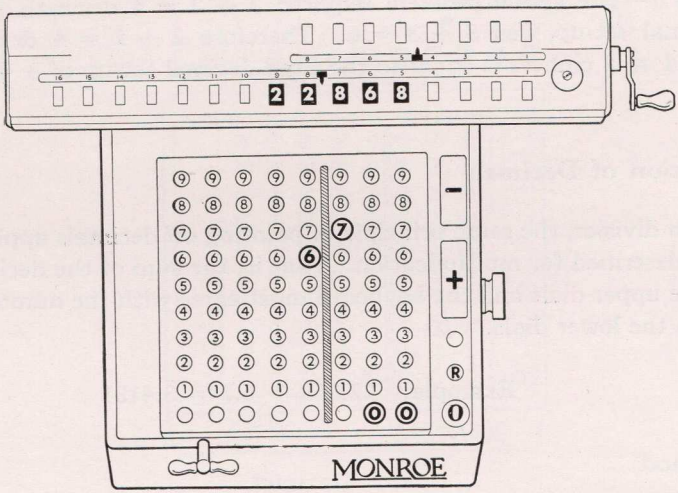


Figure 9

Step 7—Continue simple division as previously described, holding down the minus bar until the machine stops, then depressing the plus bar to correct over-division and shifting the carriage once to the left.

Step 8—The result will register automatically in red in the upper dials in correct position with relation to the decimal point which was previously set, and the final result will appear as in Figure 10. The .0002300 shown in the lower dials is the remainder.

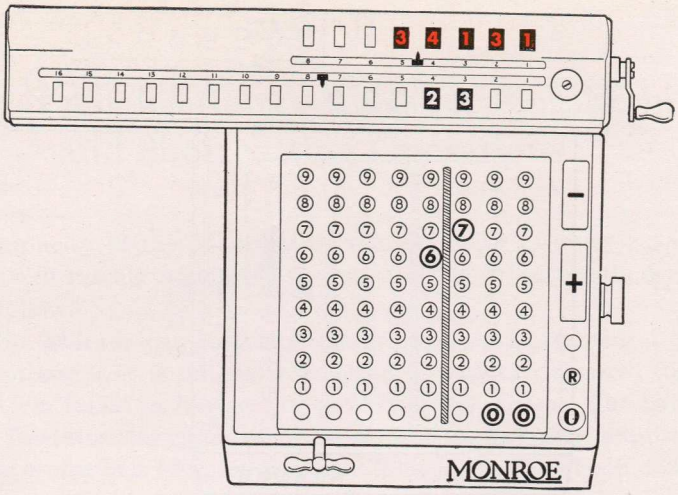


Figure 10

As in all problems of division on the Monroe, after the figures have been set up the operation is entirely automatic and it is really not necessary for the operator to watch the machine until the completion of the division when the final answer is secured.

Take another problem:

Example: $20.621 \div 6.41356 = 3.21522$

Method

Decimals: Upper Dials 6
Keyboard 5
Lower Dials 11

Step 1—The quotient in this example is to be carried out five decimal places. Therefore the upper dials decimal marker is set at 6, one more than the required 5 places.

Step 2—Since the divisor has 5 decimal places, we turn the keyboard marker over at 5. This makes it necessary that the lower dials decimal marker be set at 11, because $6 + 5 = 11$.

Step 3—Set 20.621 on the keyboard as 20.62100. Add into the lower dials with carriage in "7" position.

Step 4—Clear the keyboard and upper dials as previously described by means of the master clear key and minus bar. Set 6.41356 on the keyboard and with carriage in "7" position start the division as indicated in Figure 11.

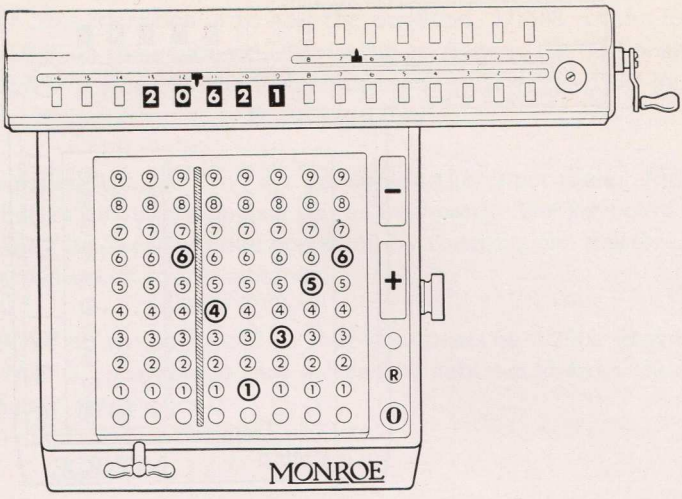


Figure 11

Step 5—Proceed with the division in the regular way. The final result will appear as in Figure 12.

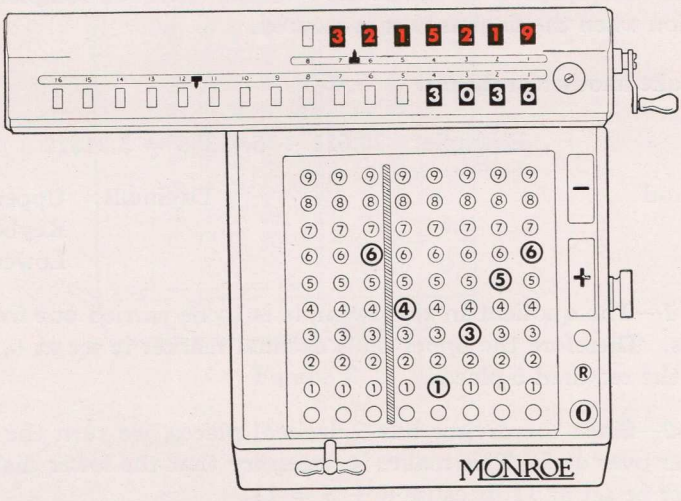


Figure 12

Step 6—The example shown in Figure 12 illustrates the advantage of setting the upper dials decimal marker at one place more than the number of places required for the quotient. In the first upper dial or the sixth place is a 9. Therefore the quotient should be read as 3.21522 and not 3.21521, which would have been the incomplete quotient if the upper dials decimal had been set at 5 places instead of at 6.

PART II

Special Applications—Rules for Simplifying and Shortcutting Operations

The simplicity of the Monroe and the flexibility of every operating feature make it readily adaptable to numerous short cut methods, some of which follow.

Since the Monroe can so easily handle the four fundamental operations of arithmetic it is naturally adapted to and can be used for any figure problem found in business or governmental offices. The handling of certain fundamental types of figure work is a necessary requirement for every operator of a Monroe machine. This instruction book describes a few of the applications most frequently used.

Problems of a special nature may be worked out by the operator, or the solution and best machine application for these specific problems can be secured from our representative in the Monroe branch office nearest you, or by writing to the General Offices of the Monroe Calculating Machine Company, Inc., at Orange, New Jersey, where a special department is maintained for the purpose of serving users.

Monroe Short Cuts

Correction of Lower Dials Amounts

If after an item has been added into the lower dials it is noticed that one or more digits in that amount are incorrect, it is not necessary to clear the lower dials and add the correct amount.

With the incorrect amount still on the keyboard, depress the minus bar. The lower dials are now clear. Then change the incorrectly set keys on the keyboard by means of the flexible keyboard or the cipher keys, and with the correct amount set on the keyboard depress the plus bar again. A great deal of time can be saved in correcting errors in this manner.

Transferring Amounts from Lower Dials

Frequently it is necessary to copy to the keyboard the amount in the lower dials. To prove the correct transfer to the keyboard it is a good plan to align the lower dials and the keyboard and then depress the minus bar. If a correct transfer has been made the lower dials will show all ciphers because the subtraction of one amount from a like amount leaves nothing.

If any figures appear in the lower dials after the subtraction has been made it is an indication that an error has been made in copying. To find the error, depress the plus bar again, restoring the original amount to the lower dials, and then correct the keyboard set-up.

Negative Subtraction

Quite often the result in the lower dials of a series of additions or of a multiplication must be subtracted from another larger amount.

Instead of noting this result on paper, clearing the dials and adding the larger amount in the machine and then subtracting from it the amount noted on paper, follow this procedure to save time and insure accuracy:

Copy the result of the addition or multiplication to the keyboard. Depress minus bar once. If the lower dials clear to zeros the amount copied to the keyboard is correct. Then depress the minus bar again once. The lower dials now show the complement of the first amount which is on the keyboard. Change the keyboard to read the second or larger amount. Depress the plus bar once and the result of the subtraction will appear in the lower dials.

Reading Negative Answers

It sometimes happens that when adding and subtracting a number of items for a net result, that result is what is termed "negative," because the minus items total to a larger figure than the total of the plus amounts.

The lower dials of the machine show a row of 9's to the left of an amount which is actually the complement of the desired net result. It is necessary to know the positive reading for this negative result. The process is very easy.

Copy to the keyboard the entire negative result, including the 9's at the left, just as it appears in the lower dials. Be sure each figure copied to the keyboard is in direct alignment with the lower dial containing that figure. Subtract twice with the minus bar and the lower dials will show the positive reading of the negative result.

Short Cut Multiplication

When a multiplier is an amount containing 7's, 8's, or 9's, as for example, 39, 198, 997, the multiplication may be accomplished by a combined use of the plus and minus bars, reducing considerably the number of revolutions required by the regular method.

Example: $2146 \times 198 = 424908$

Method

Step 1—Set 2146 on right of keyboard. Place the carriage in the "3" position. Multiply with the plus bar by 2, the equivalent of 200.

Step 2—Then move the carriage to the left two places so that it is in the "1" position. With the minus bar subtract twice. The answer, 424908, will then appear in the lower dials. In the upper dials will be 202, i.e., 200 less 2. See Figure 13.

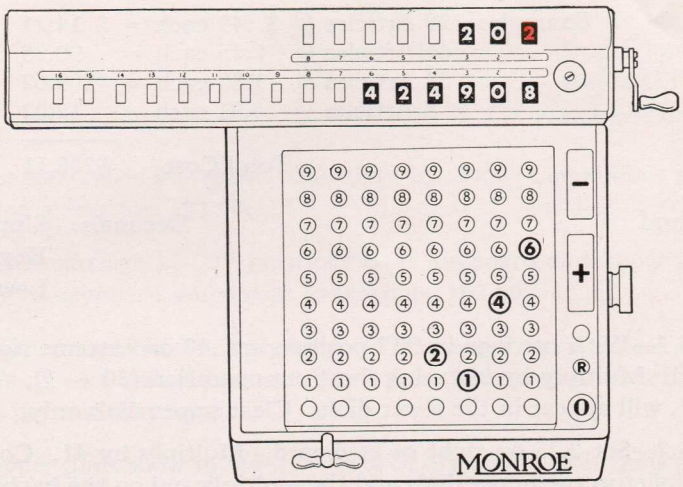


Figure 13

Solving this problem by short cut multiplication required only four revolutions of the machine, whereas the long method of multiplication would take eighteen revolutions. The total of the digits in the upper dials gives the exact number of machine revolutions by short cut or $2 + 2 = 4$, and the total of the actual digits in the multiplier, $1 + 9 + 8 = 18$, gives the number of machine revolutions required if the problem were handled by the long method.

The operator should practice this method of shortening all multiplications. For example, instead of multiplying by 88, multiply by 100 and take off 12, showing the multiplier in the upper dials as 112. Instead of multiplying by 2192, show this multiplier in the upper dials as 2212.

A little practice will enable the operator to become quite proficient in speeding up all multiplications by using short cuts such as these:

Multiplier		*Upper Dials*		*Revolutions Saved*
283	=	323	=	5
408	=	412	=	5
827	=	1233	=	8
2791	=	3211	=	12
5987	=	6013	=	19

Accumulative Multiplication

The accumulated result of a series of multiplications can be obtained on the Monroe by making one multiplication after another without clearing the lower dials after each multiplication.

Example:	29 Articles	@ $ .49 each	=	$ 14.21
	41 Articles	@ 2.25 each	=	92.25
	58 Articles	@ 1.89 each	=	109.62
	3 Articles	@ 4.01 each	=	12.03
		Total Cost		$228.11

Method

Decimals: Upper Dials 0
Keyboard 2
Lower Dials 2

Step 1—With carriage in "2" position set .49 on extreme right of keyboard. Multiply by 29, using short cut operation (30 − 1). The result, 14.21, will appear in the lower dials. Clear upper dials only.

Step 2—Set 2.25 on right of keyboard. Multiply by 41. Compare the multiplier in the upper dials and the multiplicand on the keyboard. The lower dials show 106.46, the accumulation of 14.21 and 92.25. Clear upper dials only.

Step 3—Continue same routine for each extension, in each case clearing only the upper dials. After completing the last extension the lower dials show 228.11, checking the total of the invoice as shown in Figure 14.

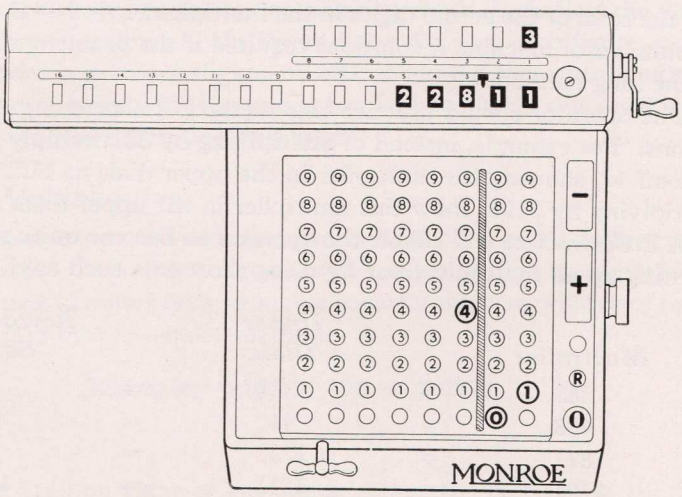


Figure 14

Discounts

Subtractive Multiplication

Example: 456 lbs. Copper @ $.22½ lb. less 12½% = $89.78

Method

Decimals: Upper Dials 3
Keyboard 3
Lower Dials 6

Step 1—Set 456.000 on keyboard. Multiply by .225. Lower dials show gross amount of invoice, 102.60.

Step 2—With carriage in "3" position, clear keyboard and upper dials only. Copy to keyboard amount in lower dials, 102.60.

Step 3—With minus bar multiply by 1. Then move carriage one place to the left and with minus bar multiply by 2. Move again to left and with minus bar multiply by 5.

Step 4—Upper dials show in red .125, rate of discount, lower dials show 89.775000 or $89.78, net of invoice, and keyboard shows 102.60, gross of invoice. See Figure 15.

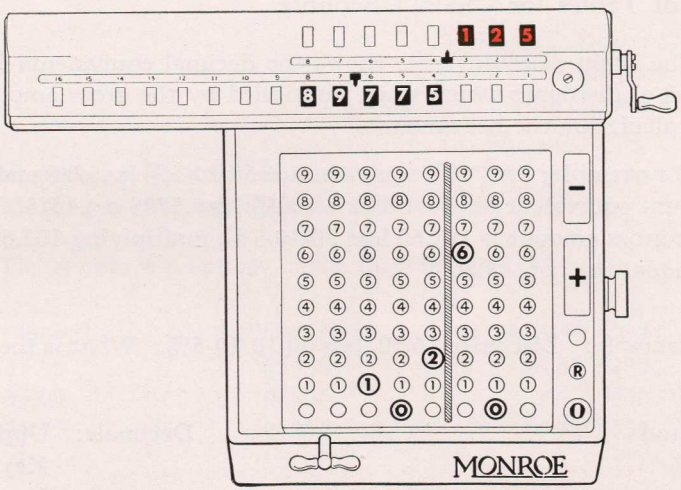


Figure 15

This process of taking off a discount is actually combined subtraction and multiplication.

Step 5—If the discount amount is desired, clear the lower dials only and with plus bar multiply by red figures in upper dials. Discount, 12.83, is in lower dials and upper dials clear to zeros as proof of multiplication.

Chain Discounts

If the figuring of chain discounts (several discounts to be taken off one gross amount) is infrequent, the same method is used as that just described for discounts, with this exception:

After the first discount has been subtracted the net amount in the lower dials becomes the new gross for the next discount and must be copied to the keyboard. The upper dials are cleared and the second discount subtracted as was the first.

If a third discount is required the second net amount becomes the new gross amount and is likewise copied to the keyboard to permit the deduction of the third discount rate.

If chain discounts are commonly in use in any office, the Monroe Calculating Machine Company, Inc., will furnish a Chain Discount Table which shortens considerably the above method of figuring chain discounts.

Use of Tables for Chain Discounts

The chain discount table shows the decimal equivalents for various chains of discounts which when multiplied by the gross amount give in one calculation the net amount.

For example, the "off" equivalent of 50-10-5% is .5725 and the chain discount equivalent on the table is 100% less .5725 or .4275. Therefore, if the gross amount is 102.60 less 50-10-5%, multiplying 102.60 by .4275 will equal the net, 43.86.

Example: List price $6.50, less 50-10-10-5%. What is the net price?

Method

Decimals: Upper Dials 2
Keyboard 5
Lower Dials 7

Step 1—From table of chain discount equivalents (Form 120-S) determine the equivalent for 50-10-10-5%, which is .38475. Set this amount on the keyboard.

Step 2—Starting with carriage in "2" position, multiply by 6.50. Lower dials show net price, 2.50.

Percentage Work

Figure work involving percentages uses all four fundamental operations—addition, subtraction, multiplication, and division. In all types of percentage work a percentage is written on the machine as a decimal, for example: 35% is .35; 4½% is .045; 5¼% is .0525.

Straight percentage work can be either the multiplication of an amount of money by a percentage figure to arrive at another amount, or it can be the division of one amount by another to arrive at a percentage.

To illustrate we show several examples and use a fixed decimal set-up which will take care of both the multiplication and the division problems.

Multiplication by a Per Cent

Example:
35% of $ 47.65 = $16.68
4½% of 55.00 = 2.48
5¼% of 356.76 = 18.73

Method

Decimals: Upper Dials 5
Keyboard 2
Lower Dials 7

Step 1—In each case set the amount of money on the keyboard and multiply by the per cent expressed as a decimal.

Step 2—The results will appear in the machine as follows:

Keyboard		*Upper Dials*		*Lower Dials*
47.65	×	.35000	=	16.6775000
55.00	×	.04500	=	2.4750000
356.75	×	.05250	=	18.7293750

Division to Secure a Per Cent

Example:
What % of 355.25 is 275.85? Answer— 77.65%
What % of 256.75 is 325.45? Answer—126.76%
What % of 175.45 is 12.85? Answer— 7.32%

Method Decimals: Same as in previous example.

Step 1—You will note in each of the above examples there is an amount which is immediately preceded by the word "of." It is a rule when figuring what per cent one amount is of another amount, that the divisor is always the "of" amount or the amount preceded by the word "of."

Step 2—Therefore, the divisors and dividends for these examples, together with the results in the upper dials, appear in the machine as follows:

Lower Dials Dividend		*Keyboard Divisor*		*Upper Dials Quotient*
275.8500000	÷	355.25	=	.77649
325.4500000	÷	256.75	=	1.26757
12.8500000	÷	175.45	=	.07324

Practical Use of Percentages

Percentages are used in business generally for the purpose of making comparisons of amounts, one amount being taken as a standard of 100% and the other amounts being converted on this basis to a percentage figure, the percentage showing the ratio of difference between the amounts. In determining increases or decreases in amounts of sales, expenses, profits, etc., the relation of one amount to another is more readily comprehended when comparisons are made by means of percentage figures.

The following examples illustrate the application of the Monroe Adding-Calculator to the various forms of this type of figure work so common to accounting and statistical work in all modern business.

Increase and Percentage of Increase

In this problem the amount of increase as well as the percentage of increase is desired.

Example: Find increase and percentage of increase that:

	Increase	*% Increase*
$2963.40 is of $1582.61	$1380.79	87.25

Method Decimals: Upper Dials 5
Keyboard 2
Lower Dials 7

Step 1—With carriage in "6" position set 2963.40 on the right of the keyboard. Depress plus bar once.

Step 2—Change keyboard set-up to 1582.61. Depress minus bar once. The amount of increase, 1380.79, appears in the lower dials.

Step 3—Now figure the percentage of increase. Shift carriage one place to the left and divide the amount in the lower dials by the amount on the keyboard. The percentage of increase appears in red figures in the upper dials, .87247 or 87.25%.

Decrease and Percentage of Decrease

In this problem the amount of decrease as well as the percentage of decrease is desired.

Example: Find decrease and percentage of decrease that:

	Decrease	*% Decrease*
$1568.05 is of $2731.65	$1163.60	42.60

Method — Decimals: Same as in previous example.

Step 1—With carriage in "6" position set 1568.05 on the right of the keyboard. Depress minus bar once. The lower dials read 99998431.95.

Step 2—Change keyboard set-up to 2731.65. Depress plus bar once. The amount of the decrease, 1163.60, appears in the lower dials.

Step 3—Shift carriage one place to left and divide. The upper dials show .42596 or 42.60% decrease.

Percentage of Increase—Percentage Only

If the percentage of increase only is required, the subtraction operation is eliminated.

Example: Find the percentage of increase that this year is of last year.

Last Year	*This Year*	*% Increase*
$369.64	$435.75	17.89

Method — Decimals: Upper Dials 5
Keyboard 2
Lower Dials 7

Step 1—Always set on keyboard last year's figure — in this case, 369.64. With carriage in "6" position depress plus bar once. Clear 1 in upper dials.

Step 2—Move carriage to "5" position and with plus bar and "build-up" division (see pages 35-36) add and shift carriage when necessary until the lower dials amount is as close to 435.75 as possible.

Step 3—Upon completion dividend in lower dials will be 435.7501140 and upper dials will show percentage of increase in black, .17885 or 17.89%.

Percentage of Decrease—Percentage Only

If the percentage of decrease only is desired, the subtraction operation is eliminated.

Example: Find the percentage of decrease that this year is of last year.

Last Year	*This Year*	*% Decrease*
2361.50	1257.65	46.74

Method Decimals: Same as in previous example.

Step 1—Always set on keyboard last year's figure — in this case, 2361.50. With carriage in "6" position depress plus bar once. Clear 1 in upper dials.

Step 2—Move carriage to "5" position and with minus bar and subtractive division subtract and shift the carriage when necessary until the lower dials amount is as close to 1257.65 as possible.

Step 3—Upon completion dividend in lower dials will be 1257.6404400 and upper dials will show percentage of decrease in red, .46744 or 46.74%.

Reciprocals

When the same divisor is used a number of times, division is shortened by multiplying each dividend by the reciprocal of the divisor. In other words, dividing one number by another is the same as multiplying that number by the reciprocal of the divisor.

Definition of a Reciprocal

The reciprocal of a number is 1 divided by that number. For example, 1 divided by 5 equals .2, and .2 is therefore the reciprocal of 5. Multiplying any number by .2 gives the same result that would be secured in dividing that number by 5, because 5 and .2 are reciprocals of each other.

Practical Use of Reciprocals

Reciprocals are used extensively in arriving at percentages and in prorating, which will later be described. They also form the basis for the preparation of tables to shorten payroll calculations, insurance figuring, cost accounting, bond calculations, and many other kinds of mathematical calculations.

Reciprocals Commonly Used

Common reciprocals used in different lines of business, which may be memorized if they are used frequently, are as follows:

Month of 28 days	.03571	144 (gross or inches to square foot)	.006944
Month of 30 days	.03333	240 pence to a pound	.004167
Month of 31 days	.03226	360 days to a year	.002778
32 lbs. to a bushel	.03125	365 days to a year	.002740
56 lbs. to a bushel	.01786	1728 cubic inches to a foot	.0005787
60 lbs. to a bushel	.01667	2240 lbs. to a gross ton	.0004464
12 (dozen)	.08333	5280 feet to a mile	.0001894
16 (ounces or 16ths)	.06250		

Tables of reciprocals from 1 to 10,000 are published by various authors but their use with the Monroe Adding-Calculator is unnecessary as reciprocals can be calculated on the machine so rapidly, and division itself is so simple that in most cases reciprocals are unnecessary for general use.

Monroe Method for Finding Reciprocals

With the Monroe the finding of a reciprocal of any number is a simple problem of division.

Method

Decimals: See "Rules for Pointing Off Reciprocals," Page 32.

Step 1—Move carriage to extreme right so that carriage is in "8" position. Since reciprocal of 144 is 1 divided by 144, prefix a 1 to 144 (1144) and set 1144 on the extreme left of keyboard. Depress plus bar once.

Step 2—With zero clear key in 8th column, clear the 1 in the 8th column of the keyboard. Do not clear the 1 in the upper dials.

Step 3—Divide with the minus bar until required number of significant figures are shown in the upper dials. In this case only four significant figures are required so divide until five dials are filled with figures to the "4" position of the carriage.

Step 4—Note that on the first revolution of the machine with the minus bar, the 144 is subtracted from the lower dials leaving only the 1 and the 1 is cleared from the upper dials.

Step 5—The result in the upper dials is 69444 but that result requires ciphers in front of it. To determine the correct position of the decimal point, see instructions which follow.

Rule for Pointing Off Decimal Places in Finding Reciprocals

The reciprocal of any whole number or of a whole number and decimal is always a decimal.

The reciprocal of any decimal is always a whole number or a whole number and decimal.

Therefore, in finding the reciprocal of a whole number it is generally necessary to prefix ciphers to the amount in the upper dials and generally no decimal point in the quotient dials is set.

In finding the reciprocal of a decimal the result in the upper dials will be whole numbers or whole numbers and decimals. Therefore, follow these rules:

Rules for Pointing Off Reciprocals

Reciprocal of a Whole Number

Prefix as many ciphers to the reciprocal found in the upper dials as there are whole numbers in the divisor, *LESS ONE*. For example, the reciprocal of 144 is .0069444.

Reciprocal of a Decimal

Point off as many whole numbers in the reciprocal found in the upper dials as there are ciphers in the divisor, *PLUS ONE*. For example, the reciprocal of .0457 is 21.8818.

Proration or Distribution

To charge a total company expense to various departments, the amount of total expense is split up based upon some known factor such as actual sales. The figuring job involved is termed proration or distribution.

For example:

Dept.	*Sales*	*Expense*
A	500	1500*
B	250	750*
C	750	2250*
Total	1500	4500

In the above example the amounts with an * were secured by prorating. We found the relationship of total sales to total expense by dividing the latter by the former. The result was 3. Then we multiplied the sales for each department by 3 and secured the prorated amount of expense for each department.

This type of figure work is very common to all business. The proration can be either a dollars and cents proration or it can be based upon percentage or a combination of both.

Example: Railroad Proration

Division	*Mileage*	*Total Receipts*	*% Due Each*	*Amount Due Each*
A	423		.526775	$5101.684
B	234		.291407	2822.204
C	146		.181818	1760.862
Total	803	$9684.75	1.000000	$9684.750

Note: Red figures are calculated figures.

Method

Decimals: Upper Dials 0
Keyboard 8
Lower Dials 8

Step 1—First add the mileages to secure total mileage, 803.

Step 2—As previously described under Reciprocals, find the reciprocal for 803 which is .00124533.

Step 3—Set .00124533 on the keyboard and multiply by 423, mileage for Division A. Result in lower dials is .526775 or 52.6775% due Division A. Do not clear keyboard or dials.

Step 4—With plus and minus bars change 423 in upper dials to mileage for Division B. Result is .291407.

Step 5—Continue same routine for Division C. Having secured these percentages it is necessary to prorate the total receipts, 9684.75, on the basis of these percentages.

Step 6—Change decimal set-up to: Upper Dials 6
Keyboard 2
Lower Dials 8

Set 9684.75 on keyboard and multiply by each percentage without clearing dials or keyboard. Use the plus and minus bars to change percentage multipliers. Be sure to add the results secured to see if they agree with the total. Sometimes it will be necessary to adjust one or two cents to make the items add to the correct total.

If the percentages are not required, only the amounts due each, the reciprocal operation can be eliminated. Divide the total receipts, $9684.75, by the total mileage, 803. This gives $12.06071, receipts per mile. Multiply this factor as a constant by each mileage for each division and this will give the same amounts as were secured through the percentage method of prorating.

Dial Transfer Multiplication

In some types of work, particularly in cases where one amount is multiplied by another amount and the result is then multiplied by a third amount, it is a saving of time to use what is called "dial transfer" multiplication.

Example: $26 \times 136 \times 427 = 1509872$

Method Decimals: None.

Step 1—With carriage in "1" position set 136 on the right of the keyboard. Multiply by 26. The lower dials show the result, 3536.

Step 2—The result in the lower dials must now be multiplied by 427. Instead of copying 3536 to the keyboard and subtracting to prove the keyboard set-up, leave this amount in the lower dials. Clear upper dials only.

Step 3—Place carriage in the "4" position so that the first digit of the result, 3, is in direct alignment with the right hand row of keys.

Step 4—Set on the keyboard the next multiplier, 427, less 1, or 426. The reason for dropping one is because 3536 is already in the dials, which is equivalent to being multiplied by one.

Step 5—Multiply by 3. Then move carriage to the "3" position and multiply by 5, which is in the dials that are directly in line with the right hand row of keys.

Step 6—Continue to move carriage to the left, digit by digit, until the upper dials read 3536, the multiplier which was in the lower dials.

Step 7—The lower dials now show the result, 1509872.

Interest

Interest may be figured by the ordinary arithmetical rule as follows: Multiply the principal by the rate, then multiply this result by the number of days and divide by 360 or 365 days in a year, as may be required.

We have worked out many shorter methods of computing interest, some of which depend upon the use of special Monroe Interest Tables or a set of reciprocal factors. These tables and explanations of the methods can be obtained upon application to the Monroe branch office nearest you.

One basic method is described here which has to its advantage the fact that only one rate or factor is necessary, regardless of the number of days or the amount of principal, provided all calculations are being made at the same rate. Furthermore, no division is required and the dial transfer method of multiplication just described is used.

Example: Find the Interest on $3475 for 32 days @ 7% = $21.62

Method

Decimals: Upper Dials 3
Keyboard 6
Lower Dials 9

Step 1—With carriage in "1" position set 3475 on extreme right of keyboard. Multiply by 32. The lower dials show the amount of principal for one day, 111200. Clear upper dials and keyboard only.

Step 2—With carriage in "6" position set on keyboard .194443, which figure represents the amount of interest for one day on $1000 on a 360 day basis. (Note: These daily rates of interest are secured from Monroe Form 456-S.)

Step 3—By dial transfer multiplication, transfer 111200 to the upper dials. The lower dials show the amount of interest, 21.62. Since the keyboard rate is based on $1000, we set the upper dials decimal at 3 so that multiplying by 111200 will really be multiplying by 111.200.

Build-Up Division

Division is sometimes more easily or rapidly accomplished when the Build-Up or additive method is used instead of the subtractive method previously described in this book. This method is particularly efficient where a constant divisor or dividend is being used.

In this method the divisor is set on the keyboard and is built up to the dividend in the lower dials by a series of additions with the plus bar. As soon as the dividend appears in the lower dials, the quotient automatically appears in the upper dials and all three amounts are visible for proof purposes as they are in multiplication.

Example: 7955 ÷ 25 = **318.2**

Method

Decimals: Upper Dials 1
Keyboard 0
Lower Dials 1

Step 1—Set 25 on right of keyboard. Move the carriage to the "4" position so that 25, if added once, would appear in the dials to be occupied by the 79 of the dividend 7955.

Step 2—With the plus bar add 25 until the lower dials show an amount as near as possible to 7955 without exceeding it. For example, if four depressions were made the lower dials would show 10000.0 which exceeds 7955.0. Therefore, the lower dials should show 7500.0 with 3 in the upper dials.

Step 3—Move carriage to the left one place to the "3" position and repeat the same routine with the plus bar. Only one depression can be made. The lower dials read 7750.0 and the upper dials 310.0.

Step 4—Move carriage to "2" position and continue the plus bar operation. Nine revolutions show 7975.0 in the lower dials which exceeds the required 7955.0 so 8 revolutions are correct with 7950.0 in the lower dials.

Step 5—Move carriage to "1" position, and when plus bar is depressed twice the lower dials show the exact dividend, 7955.0. The upper dials show the quotient, 318.2, and the keyboard the divisor, 25.

Step 6—It is well to remember that, if the divisor on the keyboard is correct, then the moment when the exact dividend (or an amount as near the exact dividend as possible and less than the dividend) appears in the lower dials, the operator has positive proof that the quotient is correct.

Simultaneous Multiplication and Division

Build-Up Method (A ten-column keyboard is advisable)

A great deal of time can be saved by multiplying the quotient of a division at the same time the division is being made. Multiplication and division are performed simultaneously by building up the dividend at the right side of the lower dials, using build-up division, at the same time the multiplier, which is set on the left of the keyboard, is being multiplied in the left side of the lower dials by the quotient.

Example: 1728 pieces @ $.26 per dozen = $37.44

For problems of this kind two sets of decimal points are required on the keyboard and in the lower dials; also a 20-place or 10-column machine should be used.

Method

Decimals: Upper Dials 2
Keyboard 10-0
Lower Dials 12-2

Step 1—Set 12, the number of pieces in a dozen, on extreme right of keyboard. Set .26 on extreme left of keyboard. Keyboard now reads .2600000012.

Step 2—Place carriage in "5" position so the 12 on right of keyboard will, when plus bar is depressed, appear in dials in which the 17 of the dividend 1728 should appear.

Step 3—Disregarding left side of lower dials, watch the right side of the lower dials so that by build-up division 1728 appears in that part of the dials.

Step 4—The upper dials show 144, number of dozens in 1728 pieces. At the 2nd decimal in lower dials the dividend, 1728, shows. The result, 37.44, shows in lower dials at 12th decimal.

Step 5—When figures are too large in number of digits this method cannot be used and the following Complementary method should be used.

Complementary Method

This method of simultaneous multiplication and division is more practical where large numbers are involved. It is subtractive division accomplished by adding with the plus bar the complement of the divisor.

The dividend is added into the right side of the lower dials. The complement of the divisor is set on the right side of the keyboard and the multiplicand *less one* on the left side of the keyboard. All nine keys between these two keyboard set-ups are depressed to connect the two amounts.

The reason for such a keyboard set-up is that with each forward revolution a 1 is carried over from the dividend. The row of connecting 9 keys automatically carries this 1 from digit to digit until it is finally added into the figures of the result of the multiplication. To compensate for this extra carry of 1 we drop 1 in the multiplicand which is set up.

Definition of a Complement

The complement of a number is the difference between that number and the next higher power of ten. Thus, the complement of 6 is 4; of 12 is 88; of 73 is 27; of 2142 is 7858, etc. To obtain a complement mentally, subtract the right hand digit of the number from 10 and other digits from 9.

To find any complement mechanically on the Monroe set the amount on the keyboard and subtract from ciphers in the lower dials with one depression of the minus bar. The amount in the lower dials to the right of the 9's is the complement of the amount on the keyboard.

Example: 1728 pieces @ $.26 per dozen = $37.44

Method

Decimals: Upper Dials 2
Keyboard 10-0
Lower Dials 12-2

Step 1—With carriage in the "3" position set 1728 on extreme right of keyboard. Depress plus bar once. Touch master clear key and minus bar simultaneously.

Step 2—On extreme right of keyboard set 88, complement of 12, number of pieces in a dozen. At the extreme left of keyboard set .25, which represents the price, .26 less 1.

Step 3—Connect these two amounts with depressed nine keys. Keyboard now reads .2599999988.

Step 4—With carriage in "5" position depress plus bar once. The 17 in the lower dials has been divided by 12 once with a remainder of 5.

Step 5—Move carriage one place to the left to the "4" position. Hold down plus bar until 52 is less than 12. Lower dials now read at right 48.00, and upper dials read 140.00.

Step 6—Move carriage again to "3" position and hold plus bar down for four revolutions. Right of lower dials is now clear. Upper dials show 144, number of dozens in 1728 pieces, and left of lower dials shows result, 37.44, at 12th decimal place.

In the same manner other types of calculations may be performed, for example, a tonnage problem:

Example: 5197 lbs. @ $25.25 per long ton.

Method

Decimals: Upper Dials 2
Keyboard 8-0
Lower Dials 10-2

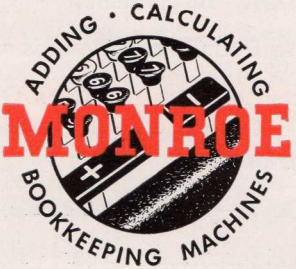
Step 1—With carriage in "3" position add in right of lower dials 5197. Clear keyboard and upper dials.

Step 2—Keyboard set-up of price less 1 cent and complement of 2240 pounds in a long ton, will be 25.24997760.

Step 3—Starting with carriage in the "3" position and dividing by the complement, the upper dials show 2.32 tons, the left of lower dials show result, $58.58.

The Monroe Calculating Machine Company, Inc., publishes for use with the Monroe Adding-Calculator many tables which further shorten and simplify figure work of certain kinds. Some of the principal ones most commonly used in business are listed here. Any of these tables will be supplied free of charge upon application to the local Monroe office or direct from the general offices at Orange, New Jersey. In requesting them please identify by form numbers.

Form No.	*Description*
117-S	Decimal Equivalents of Common Fractions—8ths to 64ths
120-S	Chain Discount Equivalents
784-S	Chain Discount "Off" Equivalents
140-S	Tons Expressed as Pounds and Pounds as Decimal of a Ton
780-S	Pounds as Decimal of Cwt., Cwt. as Decimal Equivalent of a Ton. Reverse—Hundredweight, Quarters, and Pounds as Decimal Equivalent of Ton
127-S	Days Between Dates—for prorata cancellations
159-S	Days as Decimal Equivalent of Year—365 Day Basis. Reverse—Days Between Dates
160-S	Same—360 Day Basis
802-S	Same—366 Day Basis
359-S	Trigonometric Functions
360-S	Lumber Table
456-S	Interest on $1,000 for One Day, 1/16% to 12%—360 and 365 Day Basis
539-S	Same—366 Day Basis
464-S	Conversion Factors, British—Metric—U. S. Systems
779-S	Table of British Currency
720-S	Monroe Method of Extracting Cube and Higher Roots
769-S	Monroe Method of Extracting Square Root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